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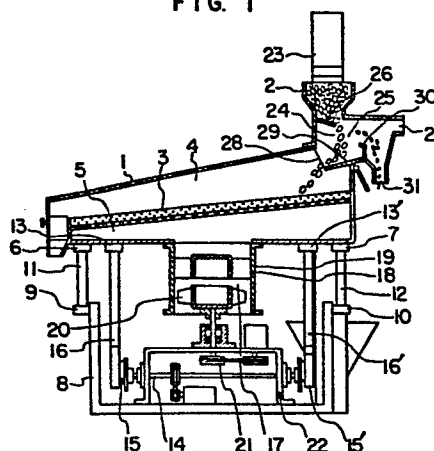
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⑤ Sorter for grains, pulses and the like.

⑤ A sorter for grains, pulses and the like having a perforated sorting plate (3) mounted on a frame (8) and adapted to be inclined with respect to the horizontal plane and to be vibrated in the longitudinal direction while being intermittently lifted toward the upper side. The perforated wall is communicated with a blower means (17) through an air duct (19, 5). The perforated wall constituting a sorting plate is provided with a corrugated surface (A) comprising a multiplicity of corrugated ribs (33) arranged in the direction opposing to the vibration of the sorting plate and in parallel rows at a pitch (W) not less than the size of the material to be sorted. A discharge portion (C) for receiving the sorted material is provided at one end of the ribs.

FIG. 1



- 1 -

SORTER FOR GRAINS, PULSES AND THE LIKE

1 This invention relates to an improvement of
a sorter for grains, pulses and the like, and more
particularly, to a sorter which is suitable for pulses
and the like that have been deemed difficult to be
5 sorted in the past because they roll very easily. The
sorter of the invention has been developed in order to
make the efficient sorting by fully utilizing differences
in coefficient of friction, specific gravity, form and
size of grains or like to be sorted, in spite of such
10 rolling characteristic that will adversely affect the
sorting.

Heretofore, there have been widely employed
two types of sorters for use in sorting pulses. The
first one is the so-called rolling sorter in which a
15 belt is inclined with respect to the horizontal plane
not only in the longitudinal direction but also in the
lateral direction, and the belt is turned toward the
upper side, while the second one is the so-called rocking
sorter in which a perforated wall sorting plate through
20 which jets of air pass and having a roughened surface
is mounted at an inclination with respect to the horizontal
plane, the sorting plate being adapted to be vibrated
in the longitudinal direction so as to cause pulses
to be moved toward the upper side and, hence, to be sorted
25 while being rocked, and the sorted pulses are discharged

1 in the direction perpendicular to the vibration, i.e.
in the lateral direction. The former sorter is to carry
out the sorting in such a manner that a mixture of the
complete grains and the damaged grains, which have
5 suffered damages done by insects, diseases, immaturity or
mechanical actions, is supplied on the belt and only
the complete grains roll over the belt sideward, whereas
the remaining damaged grains are moved toward the upper
side along the turning direction of the belt. However,
10 when the damaged grains are once rolled they are
accelerated by inertia to form the same stream as the
complete grains and, then, joined with a stream of the
complete grains. Thus, it has been deemed very difficult
to perform the high accurate sorting by the sorter of
15 this type. In the latter sorter, the sorting plate is
vibrated in order that pulses and the like which roll
very easily are moved toward the upper side while being
rocked. However, since there is provided on the inclined
surface no means to prevent from slipping, the complete
20 grains locating at the bottom of the sorting plate
also slide over the roughened surface thereof serving
as the perforated wall through which jets of air pass,
so that such complete grains flow toward the lower side
of the sorting plate and will be mixed with the damaged
25 grains. Thus, the sorting becomes imperfect. In some
of the latter sorters, several bars extending in the
rocking direction are provided on the sorting plate at
certain places, thereby to provide a proper flow

- 3 -

1 resistance in the discharging direction. But any of such
sorters includes no corrugated ribs arranged in parallel
in the direction opposing to the vibration of the sorting
plate, which ribs are essential to prevent pulses and
5 the like from unfavourably slipping due to the vibration.
As a result, it was also impossible to perform the highly
accurate sorting with the sorter of this type.

This invention is to provide such a sorter
that a perforated wall sorting plate is mounted on a unit
10 frame of the sorter to be inclined with respect to the
horizontal plane and to be vibrated in the longitudinal
direction while being intermittently lifted toward the
upper side thereof, and the perforated wall sorting plate
is communicated with a blower means through an air
15 duct, in which the perforated wall sorting plate is formed
to have a corrugated surface comprising a multiplicity
of corrugated ribs arranged in the direction opposing
to the vibration of the sorting plate and in parallel
rows at a pitch not less than the size of materials
20 to be sorted, and a discharge portion for receiving the
materials having been sorted is provided at one end
side of those ribs.

When the materials to be sorted, such as pulses,
including the damaged grains are supplied on some area
25 of the perforated wall sorting plate arranged at the
upper side thereof, the materials are spread over the
sorting plate in the form of a thin layer and this grain
layer is subject to lifting power due to the uniform

- 4 -

1 force of air jets. The complete grains having smooth
surfaces are moved toward the upper side thanks to the
rocking-up action caused by the corrugated ribs while
resting on the surface of the sorting plate, and at the
5 same time they are prevented from slipping toward the
lower side. Meanwhile, the damaged grains having rugged
surfaces, i.e. with higher coefficient of friction, rest
on the complete grains to form a layer due to large
air resistance thereof and will be subject to lifting
10 power with first priority. As a result, the damaged
grains are raised up to the top surface of the grain
layer and then slide over the grain layer, so that they
are moved toward and collected on the lower side. In
this manner, the sorting is carried out with high
15 accuracy.

More specifically, according to the invention,
the differences in coefficient of friction, specific
gravity, form and size between the complete grains and
the damaged grains are utilized as factors for the sort-
20 ing. Also in the present invention, since the corrugated
ribs are arranged in the form of parallel rows unlike
the prior sorting plate which has certain short
projections provided separately with each other, there
is formed no area through which the complete grains can
25 pass and flow toward the lower side. Therefore, the
complete grains locating on the bottom surface of the
sorting plate assuredly jump the ribs and move toward
the upper side. This eliminates such a drawback that the

- 5 -

1 complete grains may be slipped toward the lower side.

Accordingly, only the complete grains having the smooth
outer surfaces and large specific gravity are moved
toward upper side, whereas the damaged grains having the
5 rugged surfaces or anomalous forms are slipped over the
top surface and moved toward the lower side. The complete
grains and the damaged grains form respective streams
separated from each other, so that both the grains are
collected on the upper side and the lower side, respec-
10 tively. The mixed grains forms another stream locating
between the above two streams. These three streams flow
out into the discharge portion separately. In this manner,
the supplied materials are sorted in accordance with the
grades.

15 The corrugated ribs according to the invention
are not limited to those which extend in the direction
perpendicular to the vibrating direction of the sorting
plate. It is also possible to slightly incline the
corrugated ribs with respect to the above perpendicular
20 direction, thereby to accelerate the discharging. The
sorting plate can be selected to have any angle of
inclination in the discharging direction as desired.

By way of example only, certain illustrative
embodiments of the invention will now be described with
25 reference to the accompanying drawings in which:

Fig. 1 is a partially sectioned side elevational
view of a sorter in accordance with an embodiment of the
invention;

1 Fig. 2 is a plan view of the sorter shown in
Fig. 1, with a part of a sorting frame being broken
away;

 Fig. 3 is an enlarged sectional view showing
5 a part of a perforated wall sorting plate;

 Fig. 4 is an enlarged perspective view showing
a part of a perforated wall sorting plate in the prior
art;

 Fig. 5 is a partially sectioned side elevatio-
10 nal view of a sorter in accordance with another
embodiment of the invention;

 Fig. 6 is a plan view of the sorter shown in
Fig. 5, with a part of a sorting frame being broken away;

 Fig. 7 is an enlarged perspective view showing
15 a part of a perforated wall sorting plate; and

 Fig. 8 is an enlarged sectional view showing
a part of the perforated wall sorting plate shown in
Fig. 7.

 Referring first to Fig. 1 showing a sorter
20 in accordance with an embodiment of the invention,
a supply hopper (2) is provided on one end side of a
sorting frame (1) in the enclosed form and a perforated
wall sorting plate (3) is arranged within the sorting
frame (1) to be inclined with respect to the horizontal
25 plate, as described later in more detail. An air exhaust
chamber (4) is formed above the sorting plate (3), while
an air blasting chamber (5) is formed below the sorting
plate (3). These sorting frame (1), sorting plate (3)

- 7 -

1 are constructed as a unit with each other. In order that
the sorting frame (1) mounted to be inclined with respect
to the horizontal plane can be vibrated in the longitudinal
direction while being intermittently lifted toward
5 the upper side, four supporting points (6), (6'),
(7) and (7') (only (6), (7) are shown in Fig. 1)
locating at the lower surface of the sorting frame (1)
near four corners thereof are connected to four lower
supporting points (9), (9'), (10) and (10') (similarly
10 only (9), (10) are shown in Fig. 1) locating on a unit
frame (8) of the sorter via resilient supporting rods
(11), (11'), (12) and (12') (only (11), (12) are shown in
Fig. 1), respectively. Thus, the sorting frame (1) is
elastically supported on the unit frame (8). Force
15 receiving points (13), (13') of the sorting frame (1)
are connected to cranks (15), (15') of a vibrator (14),
respectively, via rods (16), (16') extending upwardly and
obliquely. Moreover, a duct tube (19) including therein
fixed blades (18) of a blower means (17) is secured at
20 the bottom of the aforesaid air blasting chamber (5),
while a rotary shaft (21) of movable blades (20) fitted
within the duct tube (19) is journalled to a fixed
frame (22) of the vibrator (14), thereby to rotate the
movable blades (20). The reference numeral (23) denotes
25 an elevator used for elevating the materials up to the
supply hopper. An outlet portion of the supply hopper
(2) is enlarged to form a winnowing chamber (24).
The winnowing chamber (24) includes at the center

- 8 -

1 thereof a winnowing passage (25) in the laterally elongat-
ed form, and a deflecting palte (26) is provided at the
outlet portion of the supply hopper (2). In addition,
a foreign matter discharge port (27) is formed in the
5 side wall of the winnowing chamber (24) in front of
the deflecting plate (26), a normal grain feeding plate
(29) including at the lower end thereof a normal grain
discharge opening (28) which also serves as an air
supply port is disposed to be inclined at the bottom of
10 the winnowing chamber (24) below the deflecting plate (26),
and a restricting plate (30) is vertically provided at
the upper end of the inclined feeding plate (29) but
its angle can be adjusted as desired. An immatured
grain discharge port (31) is formed in front of the
15 restricting plate (30), and the nromal grain discharge
opening (28) of the winnowing chamber (42) is communi-
cated with the aforesaid air exhaust chamber (4) in the
sorting frame (1).

Fig. 2 shows the perforated wall sorting plate
20 (3) which is formed of a perforated wall plate including
a great number of through holes (32) and a multiplicity
of corrugated ribs (33), and hence which has a corrugated
surface (A). The sorting plate (3) is opened at one end
side thereof in the lengthwise direction of the corrugated
25 ribs so as to form a discharge opening (C), whereas three
side walls (34), (35) and (36) are vertically provided
at the remaining three side edges, respectively, and
these side walls (34), (35) and (36) are connected to

- 9 -

1 the adjacent one, thereby to form the unitary sorting
frame (1). When a mixture of the complete grains and
the damaged grains are supplied on the sorting plate (3)
from the supply hopper (2) provided near one corner of
5 the sorting frame (1), the supplied grains are separated
into several streams flowing toward the upper side or the
lower side while moving on the sorting plate (3) in the
lateral direction. Thus separated grains are discharged
into a complete grain discharge opening (37), a mixed
10 grain discharge opening (38) and a damaged grain discharge
opening (39), respectively, which are formed in the
discharge opening (C) at the end of the sorting plate
(3).

In Fig. 1, the perforated wall sorting plate (3)
15 is disposed to be inclined with respect to the horizontal
plane in such a manner that the upper side thereof is
supported by the side wall (36) shown in Fig. 2 and the
lower side thereof is supported by the side wall (34)
along the longitudinal direction. In addition to the
20 above, the sorting plate (3) is disposed within the
sorting frame (1) to be inclined also in the lateral
direction as shown in Fig. 1 in such a manner that the
upper side thereof is supported by the side wall (35)
shown in Fig. 2. Namely, the perforated wall sorting
25 plate (3) is disposed within the sorting frame (1) to be
inclined in both the longitudinal and lateral directions
in such a manner that the corner connecting between the
side wall (35) and the side wall (36) in Fig. 2 locates

- 10 -

1 at the highest level, whereas the portion adjacent to the
damaged grain discharge opening (39) locates at the lowest
level. By means of the rods (16), (16') and the cranks
(15), (15') of the vibrator, the sorting frame (1) and
5 hence the perforated wall sorting plate (3) are longi-
tudinally vibrated while being intermittently lifted
toward the upper side in the longitudinal direction.
Thus, when the materials to be sorted are supplied on
the sorting plate (3) from the hopper (2) which locates at
10 a position near the highest corner of the sorting plate
(3), they will be subject to the rocking-up action in the
longitudinal direction.

With the arrangement as mentioned above, when
a mixture of the complete grains and the damaged grains
15 is fed into the supply hopper (2) and then the sorter
is actuated to start its operation, an air flow generated
by the blower means (17) is jetted into the air exhaust
chamber (4) from the air blasting chamber (5) through the
perforated wall sorting plate (3). The exhaust air
20 flows into the winnowing passage (25) in the winnowing
chamber (24) through the normal grain discharge opening
(28) and carries out the winnowing action of the mixed
grains which fall down from the supply hopper (2).
More specifically, the foreign matters of light weight
25 are discharged out of the sorter from the foreign
matter discharge port (27), the immatured grains with
small specific gravity are flown far in the distance
and then discharged out of the sorter from the

1 immatured grain discharge port (31), and the normal
grains (other than the foreign matters and the immatur-
ed grains of light weight) flow down and are supplied
on the sorting plate (3) within the enclosed sorting
5 frame (1). The normal grains supplied on the perforated
wall sorting plate (3) within the sorting frame (1) flow
down over the slanting corrugated surface (A) in the form
of a thin grain layer. Due to the action of air jets
passing through the perforated wall, the damaged grains
10 with small specific gravity are raised up to the top
surface of the grain layer, but to the contrary the
complete grains with large specific gravity are gathered
on the bottom of the grain layer. The complete grains
on the bottom of the grain layer flow in the lateral
15 direction while being rocked up toward the upper side
in the longitudinal direction under the longitudinal
vibration of the sorting plate (3) acting on the plural
corrugated ribs (33), thereby to form a complete grain
stream (P). The damaged grains raised up to the top
20 surface of the grain layer flow in the lateral direction
while being slipped over the upper surface of the
complete grains toward the lower side in the longitudinal
direction, thereby to form a damaged grain stream (R).
Between the two streams (P) and (R), there is further
25 formed a mixed grain stream (Q) including both the complete
grains and the damaged grains. The grains having been
sorted into those three streams (P), (Q) and (R) are
moved to the discharge opening (C) at the end of the

1 sorting plate (3) and, then, flow into the complete
grain discharge opening (37), the mixed grain discharge
opening (38) and the damaged grain discharge opening
(39) formed in the discharge opening (C), respectively.
5 Thereafter, they are discharged out of the sorter
separately.

As shown in Fig. 4, a perforated wall sorting
plate (40) of the prior sorter mainly used for grains
is so constructed that air jet holes (41) in the form of
10 a projection for jetting air upwardly and obliquely
are arranged to form a multiplicity of parallel rows
with a suitable space therebetween, and the air jet holes
on the odd-numbered rows and on the even-numbered rows
are disposed in the staggered relationship. Therefore,
15 plural complete grains and damaged grains are mixed and
interposed to form a grain mass on the strip-like plate
surface (42) in front of each air jet hole (41). This
entails such a drawback that the air jets passing
through the air jet holes (41) can not assuredly raise
20 up the damaged grains with small specific gravity.

To the contrary, in this embodiment there is
employed the perforated wall sorting plate which is
formed of the perforated wall plate including a great
number of through holes (32) and a multiplicity of
25 corrugated ribs (33) and hence which has the corrugated
surface, and the pitch (W) or space between the ribs
(33) is selected to be not less than a grain size, so
that the complete grains with large specific gravity,

- 13 -

1 which gather on the bottom of the grain layer due to the
action of air jets through the perforated wall, are
fitted in grooves formed between the respective ribs
(33), whereas the through holes locating at the top of
5 each rib (33) will remain in the open state. The damaged
grains with small specific gravity raised up by the
action of air jets rest on the complete grains or over
the adjacent complete grains, so that those damaged
grains locating in the top surface of the grain layer
10 are easily and vigorously lifted up by the air jets
passing through the through holes at the top of the
ribs and, then, slide over the grain layer toward
the lower side, thereby to form the damaged grain stream.
Meanwhile, the complete grains fitted in the aforesaid
15 grooves are assuredly rocked up toward the upper side
due to the longitudinal vibration of the corrugated
surface of the sorting plate while being intermittently
lifted toward the upper side, thereby to form the complete
grain stream. Consequently, the sorting performance will
20 be improved positively and the sorting efficiency will
be increased significantly.

Figs. 5 to 8 illustrate a second embodiment of
the invention. A sorter shown in Fig. 5 is similar to
that in accordance with the foregoing embodiment as
25 shown in Fig. 1 except for the following three points.
The first point is that the winnowing chamber provided
below the supply hopper (2) in the embodiment of
Fig. 1 is dispensed with and, hence, the grains to be

1 sorted are directly supplied on the perforated wall
sorting plate (3) from the hopper (2) through a supply
opening (43). The second point is that the top of the
sorting frame (1) is covered with a perforated wall
5 (44) and air is exhausted through perforations formed in
the wall (44). The third point is that the perforated
wall sorting plate (3) has a further improved construction.
The description about the remaining similar parts will
not be repeated here.

10 A corrugated surface (B) of the perforated
wall sorting plate (3) shown in Fig.6 includes a multi-
plicity of parallel corrugated ribs (33), a multiplicity
of parallel elongated grooves (45) formed between each
adjacent ribs, and a great number of through holes (32),
15 as will be seen from an enlarged perspective view of
Fig. 7.

As shown in Fig. 3, the perforated wall sorting
plate (3) used in the foregoing embodiment of Fig. 1 has
been constructed such that a multiplicity of corrugated
20 ribs (33) are arranged in the form of saw teeth in cross-
section and V-shaped grooves are formed between those
ribs. Therefore, in many cases, the damaged grains or
large dusts mixed with the complete grains are apt
to be fitted in the V-shaped grooves and immobilized
25 between the adjacent ribs with a part of such grain or
dust being inserted into the through hole (32), so
that the bottom surface of the grooves is raised up.
Since the sorting plate (3) is disposed to be inclined

1 to some degree, the complete grains which are easy to
roll may get over the top of the ribs (33) from thus
shallowed bottom of the grooves and may roll on the
sorting plate toward the lower side thereof. Thus, the
5 sorting accuracy tends to be lowered slightly. In view
of the above, the perforated wall sorting plate (3)
is further improved in the second embodiment. As will
be seen from Fig. 8, there are provided a multiplicity
of parallel corrugated ribs (33) and parallel elongated
10 grooves (45) so as to form the corrugated surface (B),
and each elongated groove (45) is formed to have a flat
bottom surface of a width (X) slightly greater than a
length (L) of the complete grains. Accordingly, each
groove is enlarged in its width than that of the first
15 embodiment, so that a force of air jets passing through
the perforations of the bottom wall of the sorting plate
is increased. This makes it possible to eliminate the
aforesaid unfavorable phenomenon such that the damaged
grains and large dusts may be held and immobilized between
20 the adjacent ribs. Furthermore, by increasing a vibra-
tion force of the perforated wall sorting plate (3),
there can be obtained still another effect that each
two complete grains fitted in the elongated groove (45)
as viewed in the cross-section are rocked up at one time
25 and, hence, the sorting efficiency is increased signifi-
cantly.

WHAT IS CLAIMED IS:

1. In a sorter for grains, pulses and the like wherein a perforated wall sorting plate (3) is mounted on a unit frame (8) of said sorter to be inclined with respect to the horizontal plane and to be vibrated in the longitudinal direction while being intermittently lifted toward the upper side, and said perforated wall sorting plate is communicated with, a blower means (17) through an air duct (19, 5) characterized in that said sorting plate (3) is formed to have a corrugated surface (A) comprising a multiplicity of corrugated ribs (33) arranged in the direction opposing to the vibration of said sorting plate and in parallel rows at a pitch (W) not less than the size of materials to be sorted, and a discharge portion (C) for receiving the materials having been sorted is provided at one end side of said corrugated ribs.

2. A sorter according to Claim 1, characterized in that said perforated wall sorting plate is formed to have a corrugated surface (B) by providing an elongated groove (45) between each adjacent ribs (33) of said multiplicity of parallel ribs, each of said elongated groove being formed to have a flat bottom surface of a width slightly greater than a length (L) of the materials to be sorted.

1/4

FIG. 1

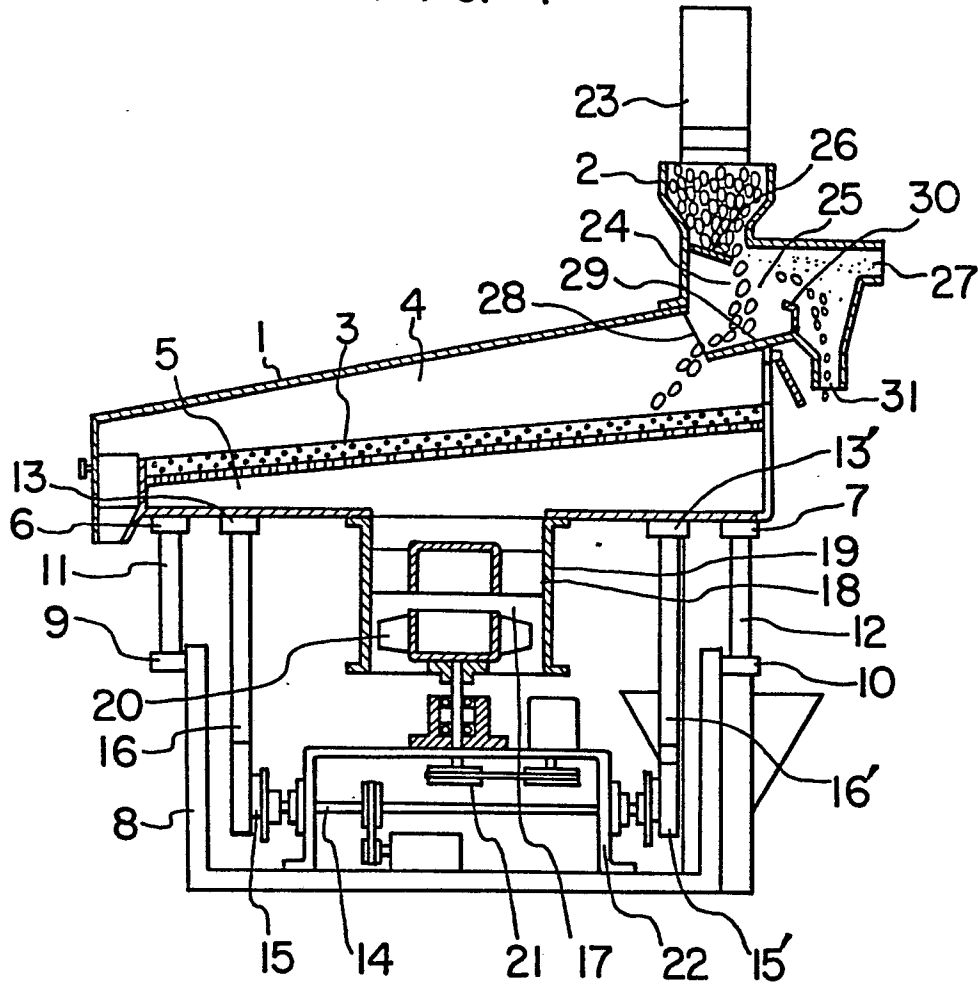
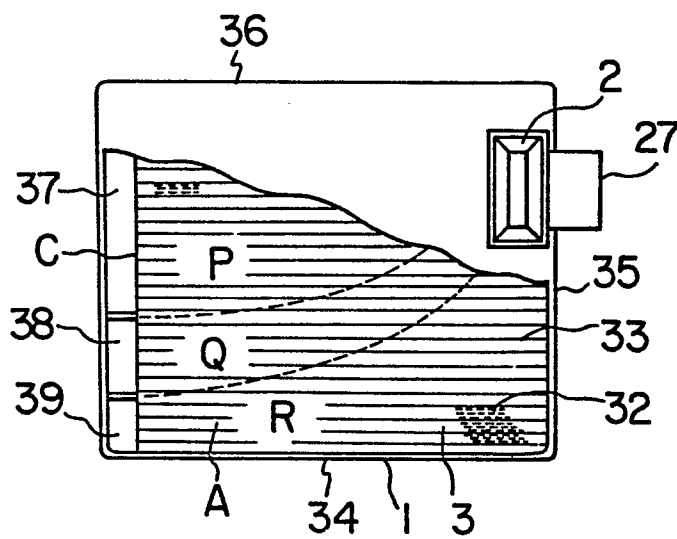


FIG. 2



2/4

FIG. 3

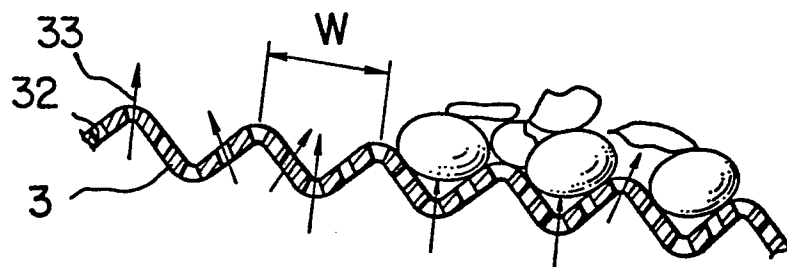
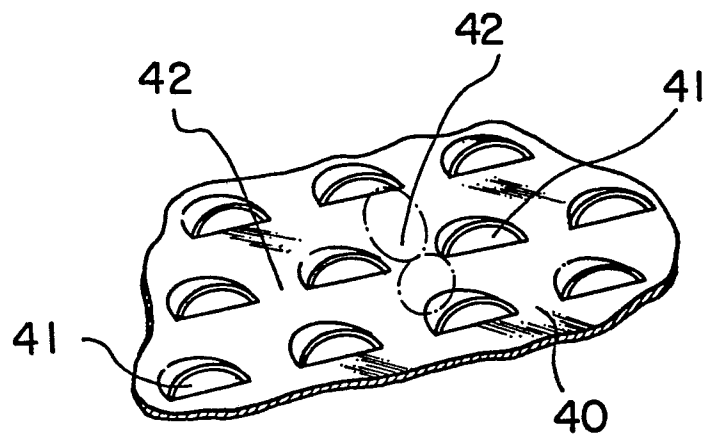


FIG. 4



3/4

FIG. 5

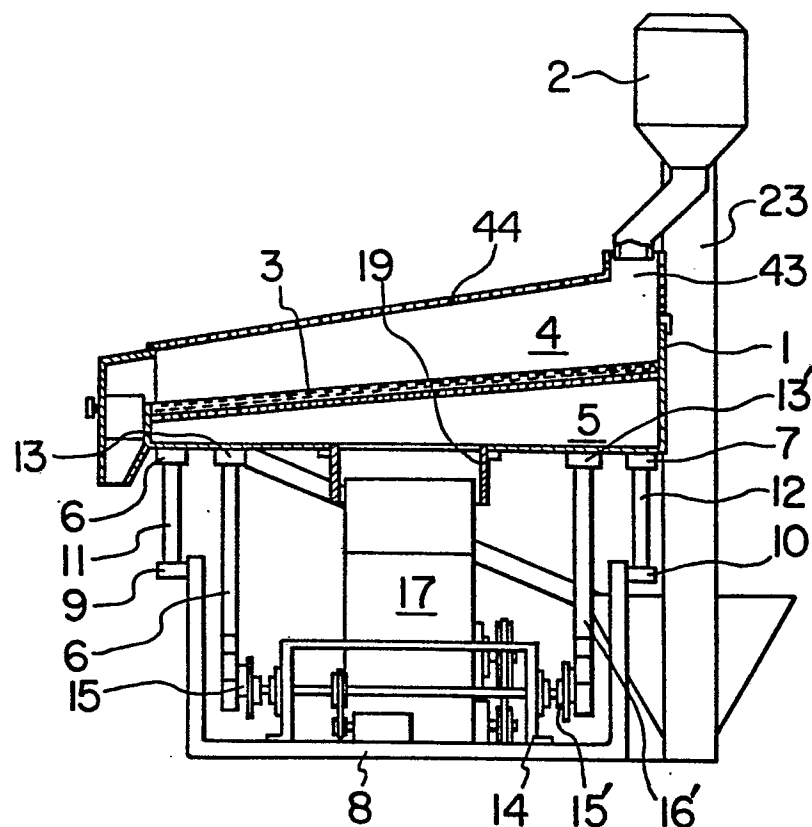


FIG. 6

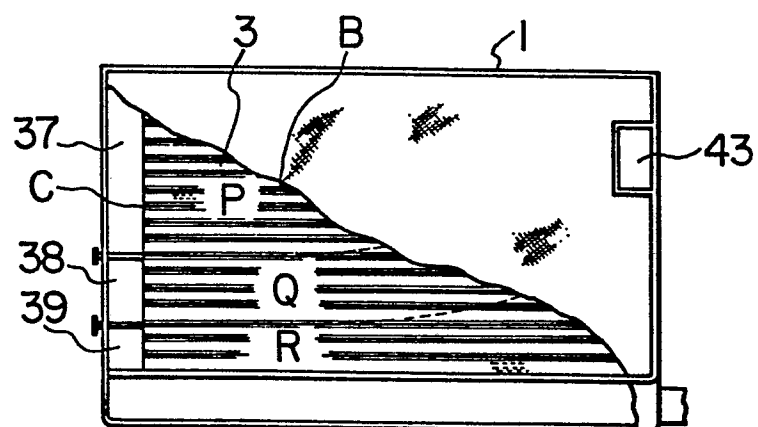


FIG. 7

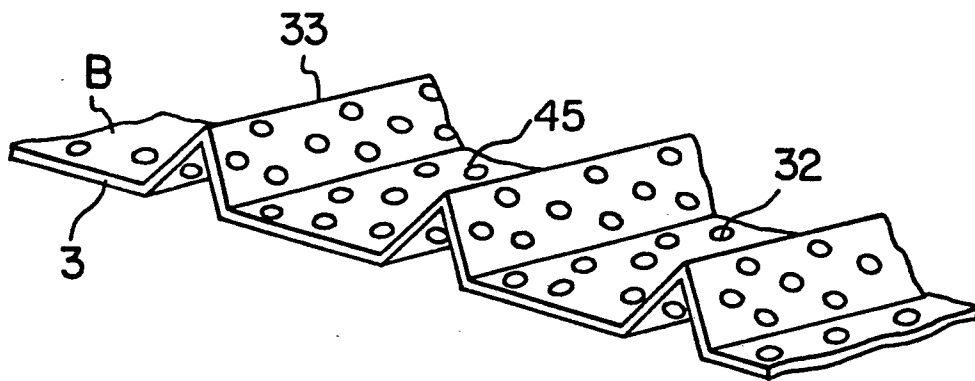


FIG. 8

